# The trade credit channel revisited

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*Published in:*
Small Business Economics

*DOI:*
10.1007/s11187-011-9344-5

Small Bus Econ (2013) 40:101–118
DOI 10.1007/s11187-011-9344-5

# The trade credit channel revisited: evidence from micro data of Japanese small firms

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Accepted: 11 April 2011 / Published online: 3 June 2011


**Abstract** It is suggested that trade credit can be a substitute for bank loans for small- and medium-sized enterprises (SMEs) that have little access to external funding sources. Using unique cross-sectional survey data of Japanese SMEs, we conduct a deep investigation into the substitutability between bank loans and trade credit. This survey contains rich information on the suppliers of trade credit to SMEs, thus enabling the examination of the channel through which credit is provided from suppliers to customers. We find that SMEs with little access to bank credit depend more on large suppliers for trade credit. We also find that when a purchase is made from a large supplier, more credit is indeed provided in the form of trade credit. Furthermore, this channel of credit from large suppliers to SMEs is only observed for solvent customers, not for insolvent customers. Our findings suggest that trade credit plays an important role for entrepreneurial firms over the financial growth cycle. For young and small firms with little access to bank loans trade credit is an important funding source.

**Keywords** Trade credit · Bank loans · Redistribution of credit · Insolvency

**JEL Classifications** D22 · L14 · G20 · L26

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## 1 Introduction

It has been asserted that trade credit is a substitute for bank loans. This is especially true for small- and medium-sized enterprises (SMEs) that have few alternative credit sources and are more likely to face credit rationing during a tight monetary regime. The substitution mechanism premise maintains that suppliers with better access to credit will redistribute the credit they receive to SMEs by way of trade credit. This is the so-called redistributional view of trade credit. The redistributional hypothesis has two important testable implications. First, SMEs with little access to bank credit depend more on large suppliers for trade credit. Here, we proxy accessibility to bank credit by firm size. Second, a considerable amount of credit is provided by large suppliers to SMEs in the form of trade credit. This trade credit channel might be potent, especially during periods of tight money when the SMEs are more likely to be

constrained in the bank credit market. As appealing as these implications are, very few tests of this hypothesis have been conducted using micro data. This is probably due to the paucity of firm-level transaction and relationship data between suppliers and customers.

The aim of this study is to test the redistributional hypothesis of trade credit from the corporate demand side by using unique cross-sectional data of Japanese SMEs. The dataset is the *Basis Survey of Small and Medium-sized Enterprises* conducted by the Small and Medium Enterprise Agency. It is a comprehensive survey that was initiated in the 2004 fiscal year to investigate financial and managerial aspects of SMEs as well as business investment trends. The survey includes information on transactions between firms (the firms to which goods are sold and the firms from whom goods are purchased) in addition to balance sheets and profit and loss statements of individual SMEs.

This dataset is ideal for examining the redistributional role of trade credit from the demand side, as the customers that benefit most from credit redistribution are SMEs, and our dataset contains rich information about the suppliers of trade credit to SMEs. To the best of the authors' knowledge, there is no other dataset like ours that contains this kind of detailed information about suppliers. We test two key implications of the redistributional hypothesis of trade credit. First, we examine the relationship of the dependence on bank credit by SMEs whose vendors are large firms. Second, we examine the amount of accounts payable extended to the SMEs by large suppliers. Consider an SME that has limited access to bank credit and is likely to be borrowing-constrained. If the SME increases transactions with large suppliers and they extend trade credit to the SME, then we can say that the redistributional hypothesis is supported. Our estimation results show that the redistributional hypothesis is indeed supported for solvent firms but not for insolvent firms.

Furthermore, we find that bank loans and trade credits are substitutes even for insolvent firms, but substitutability is independent of the extent to which purchases are made from large suppliers.

The article is organized as follows. Section 2 surveys past studies on the redistributional hypothesis of trade credit and contrasts our study with the prior literature. We also state the testing procedure of the redistributional hypothesis. Section 3 explains the dataset we use and provides the descriptive statistics on trade credit of the Japanese SMEs in our dataset. Section 4 presents the empirical evidence on the redistributional hypothesis of trade credit. Section 5 concludes the study.

## 2 Redistributional view of trade credit: literature survey and empirical strategy

### 2.1 Literature survey and contribution of our study

Meltzer (1960) first emphasized the redistributional role of trade credit. He hypothesized that firms with easy access to bank credit can increase credit in the form of trade credit more easily than those firms that are constrained in the bank loan market. In general, the firms with easy access to bank credit are large firms, and those constrained in the bank loan market are small firms. Thus, the result is a redistribution of credit among firms by size. He found evidence for this redistributional view in the time series data, especially during periods of tight money. Following this study, Jaffe (1971), Ramey (1992) and Nilsen (2002) obtained similar evidence supporting the redistributional view from time series data.[1]

Petersen and Rajan (1997) conducted the first study, based on U.S. firm-level data, of the redistributional role of credit. Based on the National Survey of Small Business Finance (NSSBF), they found that a firm's access to external finance has a significantly positive effect on the number of accounts receivable. They also found that firms with large unused lines of credit demand less trade credit. Furthermore, they found that a longer relationship with a financial institution is negatively correlated with a demand for trade credit. Thus, they concluded that trade credit is used mainly by firms that are constrained by their institutional lenders.[2] Nilsen (2002) extended the Petersen and Rajan (1997) study for listed firms and

[1] Gertler and Gilchrist (1993), on the other hand, find that trade credit does not increase during a period of tight money.

[2] In contrast, Giannetti et al. (2011) challenged the notion that the firms with little access to bank credit use trade credit. Based on the 1998 NSSBF, they found that the firms receiving trade credit secure financing from relatively uninformed banks. It implies that the extension of trade credit reveals favorable information to other lenders.

found that even large firms increase demand for trade credit during periods of tight money if they have no bond rating. In the context of the commercial paper market, Calomiris et al. (1995) found that the correlation between inventory changes and accounts payable is relatively high for firms without access to public debt markets. This supports the contention that when hit by an unanticipated increase in inventories, firms without access to commercial paper partly finance increased inventories by increasing their accounts payable to firms with better access to short-term credit. De Haan and Sterken (2006) used a pan-European dataset of both listed and unlisted firms and found that a monetary contraction affects private firms' trade credit more negatively than the trade credit positions of public firms.

A study by Love et al. (2007) focused on the redistributional role of trade credit based on international micro data. They showed that the redistribution channel shuts down during financial crises when all sources of finance available to large firms dry up. Using data of firms operating during the 1994 peso devaluation in Mexico and the 1997 Asian crisis, they found that accounts receivable drop sharply during the post-crisis period. They concluded that the firms' lack of access to bank loans forces them to reduce the supply of trade credit to the SMEs.

McMillan and Woodruff (1999) use unique survey data of Vietnamese firms that contain detailed information on the relationships between individual firms and their customers. By estimating the supply equation of trade credit, they found no relationship between offering credit to customers and receiving bank loans. However, they found that receiving credit from suppliers significantly increases the likelihood of offering credit to customers.

As for evidence specific to Japan, there are a growing number of studies that address this issue. For example, Ono (2001) and Ogawa (2003) are two recent studies that are based on time series data. Ono used the interest differential between the bank loan rate and the bill discount rate as one of the determinants of accounts payable and found that, on the whole, this interest differential exerts a significantly positive effect on accounts payable, indicating that trade credit and bank loans are substitutes. Ogawa (2003) included the lending attitude of financial institutions as one of the explanatory variables in a trade credit regression and found that when the lending attitude becomes more severe, accounts payable of medium-sized firms increase significantly, supporting the redistributional view.[3] On the other hand, Taketa and Udell (2006) find some evidence that trade credit and financial institution lending are complements of one another during periods of financial crisis.

The Takehiro and Ohkusa (1995) study is the first that is based on micro data of Japanese firms. Using the panel data of listed firms over 26 years (1967–1992), they found that an increasing severity in lending attitudes of financial institutions significantly reduces trade credit. This evidence suggests that bank credit and trade credit are complements rather than substitutes. Uchida et al. (2006) investigate the relationship between bank loans and trade credit by using a variable to represent the strength of the buyer–seller relationship in a bank loan regression. Their results are favorable and support the view that while bank loans and trade credit are complements, they are statistically insignificant.

Other studies based on micro data are generally favorable to the redistributional view. Using the Credit Risk Database, Tsuruta (2008) found that when the bank loan rate increases, borrowers increase trade credit. Tsuruta (2007) also found evidence of trade credit problems during the Asian financial turmoil in 1997 and 1998 using the same dataset. Using the data of large trading companies that supply both loans and trade credit, Uesugi and Yamashiro (2004) found that large trading companies increase accounts receivable when banks are unwilling to lend.

On the other hand, Uesugi (2005), using micro data of SMEs for the period from 2001 to 2003, found that trade credit and bank loans are complements. Fukuda et al. (2006) showed that substitutions between bank loans and trade credit are observed when the banking sector is healthy but that during the financial crises of the late 1990s and early 2000s, bank loans and trade credit contracted at the same time. This evidence is in line with Love et al. (2007).

[3] Lending attitude of financial institutions, released by the Bank of Japan, is a diffusion index that is the proportion of the firm's feeling the current lending attitude of financial institutions is accommodating minus that of the firm's feeling the current lending attitude of financial institutions is severe.

To summarize the evidence from the studies in Japan, the redistributional view, as a whole, is supported by both time series and micro data, but the complementary relationship between bank lending and trade credit is also observed during periods of financial crises.[4]

What has been lacking in past empirical studies that have examined the redistributional view of trade credit is that the information on the suppliers that provide trade credit and the customers that receive trade credit is not taken into account explicitly when bank credit becomes difficult to obtain. An exception is the study of Boissay and Gropp (2007). Based on a unique dataset of French firms, they estimate trade credit default chains. They show that small, illiquid firms with little access to outside financing pass liquidity shocks on to their suppliers by defaulting on trade credit. In this way, liquidity shocks are transmitted down from trade credit chains until they reach large firms with access to outside financing to absorb the shocks and inject new liquidity into the system. Indeed, their study finds *indirect* evidence that supports the redistributional view of trade credit by focusing on the trade credit default chains. However, they do not examine whether large and liquid firms extend more trade credit to illiquid firms with little access to outside financing.

We, however, take a more direct approach to test the redistributional view of trade credit. The redistributional view states that *large* firms that have greater access to bank loans increase the supply of trade credit to the *small- and medium-sized* customers constrained in the bank loan market. To test this view rigorously, we need transaction data of trade credit between firms. Fortunately, our micro data, to be explained in detail in the next section, contains information on the fraction of SMEs that purchase from large suppliers, which enables us to shed light on the redistributional view from the demand side.

Given this information, we test two implications of the redistributional hypothesis. First, we examine the relationship between SMEs' bank dependence and their transactions with large suppliers. According to the redistributional view, when SMEs have weaker relationships with banks, they cannot raise funds easily from banks at a lower price so that they will be more inclined to depend on large suppliers for trade credit.

Second, we examine the link between dependence on large suppliers and the amount of trade credit given to the SMEs. It is expected that the more reliant SMEs are on large suppliers, the more credit will be provided in the form of accounts payable to the SMEs. Testable equations corresponding to the two implications above will be formalized in Sect. 4. Should the two implications both be supported by the data, we may conclude that the redistributional hypothesis of trade credit is valid.

### 2.2 Empirical strategy

As is clear from the discussions above, the test of the redistributional view is restated as an examination of the extent to which trade credit can be substituted for bank loans. Therefore, the essential problem with finding evidence of the redistributional view of trade credit is the identification of the effects of supply and demand. Although we attempt to shed light on the distributional view from the demand side of trade credit, it should be noted that dependence on large suppliers, a key variable linking the two implications when testing the distributional view, is endogenous. For example, a positive productivity shock to large suppliers might induce them to sell their products at favorable conditions on trade credit. This may then prompt customers to switch from small to large suppliers, a change accompanied by an increase in accounts payable. Note that, in this example, a positive correlation between dependence on large suppliers and accounts payable originates from a shock to suppliers.

Therefore, in testing the redistributional hypothesis of trade credit from the *demand* side, it is essential to extract from the total variations of dependence on large suppliers those attributable to the demand side of trade credit. To be more specific, we need an instrument of customers' attributes that can be used to explain the dependence on large suppliers. This identification problem can be solved by making use of institutional information about credit rationing and other informational asymmetries of customers. One candidate appropriate for an instrument can be found in the bank-firm relationship or the main bank

[4] Japan's Small Business Research Institute (2005) also states that trade credit is a substitute for bank loans for small firms with less liquidity. Its analysis is based on descriptive statistics of firm-level data.

relationship of customers. In Japan, a firm usually establishes a long-term relationship with a specific bank, referred to as the main bank. Main banks play the role of delegated monitors and supply loans to their affiliated firms. Information of affiliated firms is accumulated in main banks by way of long-term multiple transactions, which play a vital role in mitigating asymmetry of information between lenders and borrowers. As will be explained in detail in the next section, we have the information on what type of main bank the sample firms are affiliated. If a firm is affiliated with a city bank, a large bank operated by both domestic and foreign operations, cheap credit is available from the main bank so that the firm has less incentive to purchase from large suppliers to obtain credit in the form of trade credit. Thus, we observe less dependence on large suppliers and, hence, less demand for accounts payable. In other words, by regressing the extent to which a customer depends on large suppliers on the main bank information of the customer, our instrument, with other explanatory variables we obtain the predicted value of the regression, that is, the variations of the dependence on large suppliers attributable to the demand factors of trade credit.

## 3 Data characteristics and descriptive statistics of SME trade credit

The Small and Medium Enterprise Basic Law in Japan stipulates that rigorous statistical investigations should be conducted to understand the actual conditions of SMEs. To attain this goal, the SME Agency has conducted the *Basic Survey of Small and Medium-sized Enterprises* since the fiscal year of 2004. This is a comprehensive survey that investigates all aspects of SMEs, including financial conditions, managerial information and the trend of business investments.[5]

The survey includes important information on transactions of intermediate goods between firms in addition to the basic balance sheet (B/S) and profit and loss (P/L) statements of individual SMEs. Specifically, it has information on the fraction of goods purchased from large and small suppliers as well as the fraction of intermediate goods sold to large and small enterprises and individual consumers.[6] This information can be used to shed light on the pattern of trade credit between firms of different sizes.

In this study, we use the survey from fiscal year 2004. We randomly selected 100,000 firms from 4.35 million SMEs in all of Japan. The number of firms available in the survey for our statistical purpose was 41,807, but the information on accounts payable and related statistics was available only for the subset of 1,659 firms on which our study is based.[7] Table 1 compares the distribution of sampled firms across industries in our study with the distribution of 12,603 incorporated firms in the survey where full information on B/S and P/L statements is available. In our study, the wholesale industry has the largest share (35.7%) followed by the retail industry (24.5%) and the manufacturing industry (18.4%), while in the survey, the transportation industry has the largest share (22.5%), followed by the service industry (15.9%) and the manufacturing industry (12.2%). The first column of panel A in Table 2 shows the distribution of sampled firms by employees in our study, which is compared with that in the survey (the fourth column). Approximately one-fourth of the firms have fewer than five employees, while one-third have more than 50 employees. The first (fourth)

[5] In the survey, an SME is defined as an enterprise with equity capital less than 300 million yen or total employees less than 300 persons for construction, transportation, manufacturing and some of the real estate and service industries. For the other industries, the SME is defined as an enterprise with an even smaller amount of equity capital and/or a fewer number of employees.

[6] The definition of the SME in footnote 5 is applicable throughout the article.

[7] In 41,807 sample firms, 12,603 firms are incorporated firms and the rest are proprietorships. The full information on B/S and P/L statements is available only for the former firm group; only limited information is available for the latter group. In addition, because our main concern is bank-firm relationships, firms with no responses to the questions on bank-firm relations, which amount to 6,256 out of 12,603 firms, are excluded from the sample. The information on the buyer of intermediate inputs is also indispensable in this study, which is available for 3,265 firms. After excluding firms with inconsistent items in B/S and P/L statements, together with the data screening stated above, the number of firms in the final sample is reduced to 1,659. Detailed comparative information of the data characteristics between our study and the original survey is available from the following website: http://www2.kobe-u.ac.jp/~tokutsu/PDF/SBE_Data_Appendix.pdf.

**Table 1** Sample distribution by industry

| Industry | (1) Number of firms in this study | (2) Number of firms in the survey |
|---|---|---|
| (1) Construction | 66 (4.0) | 1,376 (10.9) |
| Manufacturing: (2) to (23) | 306 (18.4) | 1,541 (12.2) |
| (2) Food products | 58 (3.5) | 181 (1.4) |
| (3) Beverage, tobacco, and fodder | 11 (0.7) | 20 (0.2) |
| (4) Textiles | 8 (0.5) | 57 (0.5) |
| (5) Wearing apparel | 14 (0.8) | 60 (0.5) |
| (6) Wood products except furniture | 16 (1.0) | 49 (0.4) |
| (7) Furniture | 3 (0.2) | 19 (0.2) |
| (8) Paper and paper products | 7 (0.4) | 56 (0.4) |
| (9) Printing and publishing | 9 (0.5) | 115 (0.9) |
| (10) Chemicals and chemical products | 15 (0.9) | 54 (0.4) |
| (11) Coal and oil products | 1 (0.1) | 2 (0.0) |
| (12) Plastic products | 25 (1.5) | 87 (0.7) |
| (13) Rubber products | 4 (0.2) | 19 (0.2) |
| (14) Leather and leather products | 3 (0.2) | 9 (0.1) |
| (15) Stone, clay, and glasses | 19 (1.1) | 59 (0.5) |
| (16) Iron and steel | 12 (0.7) | 43 (0.3) |
| (17) Non-ferrous metal products | 4 (0.2) | 26 (0.2) |
| (18) Metal products | 24 (1.4) | 140 (1.1) |
| (19) General machinery | 33 (2.0) | 193 (1.5) |
| (20) Electrical machinery | 25 (1.5) | 188 (1.5) |
| (21) Transportation equipment | 6 (0.4) | 101 (0.8) |
| (22) Precision instrument | 5 (0.3) | 34 (0.3) |
| (23) Miscellaneous manufacturing | 4 (0.2) | 29 (0.2) |
| (24) Information and communication | 49 (3.0) | 790 (6.3) |
| (25) Transportation | 59 (3.6) | 2,830 (22.5) |
| (26) Wholesale | 593 (35.7) | 1,383 (11.0) |
| (27) Real estate | 34 (2.0) | 1,271 (10.1) |
| (28) Hotels and restaurants | 29 (1.7) | 463 (3.7) |
| (29) Service | 117 (7.1) | 2,001 (15.9) |
| (30) Retail | 406 (24.5) | 948 (7.5) |
| Total | 1,659 (100.0) | 12,603 (100.0) |

The figures are the percentage of the total

Data source: *Basic Survey of Small and Medium-sized Enterprises*

column of panel B in Table 2 shows the distribution of sampled firms in our study (in the survey) by equity capital. Surprisingly, approximately half of the sampled firms both in our study and in the survey have less than 10 million yen equity capital. The distribution of sampled firms by firm size closely represents the original distribution of the survey.

A major advantage of the survey is that it contains rich information on the main bank relationships. The first column of panel A in Table 3 shows with what type of main bank the sample firms are affiliated. The main bank of approximately half of the sampled firms is a regional bank that has its banking business in the prefecture of the firms' headquarters. Approximately 27% of the sampled firms selected a city bank as their main bank. Shinkin banks and credit cooperatives, financial institutions that exclusively lend to SMEs, were chosen as the main bank by 22% of the sampled firms.

The information on the type of collateral and personal guarantees and on the response of the main bank to loan applications is also summarized in the

**Table 2** Sample distribution by scale of firms

| Scale of firms | (1) Number of firms in this study | (2) Number of solvent firms in this study | (3) Number of insolvent firms in this study | (4) Number of firms in the survey |
|---|---|---|---|---|
| Panel A: number of employees | | | | |
| (1) 5 or less | 393 (23.7) | 262 (18.6) | 131 (52.6) | 3,599 (28.6) |
| (2) 6–20 | 334 (20.1) | 276 (19.6) | 58 (23.3) | 3,119 (24.7) |
| (3) 21–50 | 410 (24.7) | 375 (26.6) | 35 (14.1) | 3,228 (25.6) |
| (4) More than 50 | 522 (31.5) | 497 (35.2) | 25 (10.0) | 2,657 (21.1) |
| Total | 1,659 | 1,410 | 249 | 10,616 |
| Panel B: equity capital | | | | |
| (1) 10 million yen or less | 815 (49.1) | 633 (44.9) | 182 (73.1) | 7,284 (57.8) |
| (2) More than 10 million yen to 30 million yen | 402 (24.2) | 363 (25.7) | 39 (15.7) | 2,909 (23.1) |
| (3) More than 30 million yen to 50 million yen | 221 (13.3) | 205 (14.5) | 16 (6.4) | 1,217 (9.7) |
| (4) More than 50 million yen to 100 million yen | 160 (9.6) | 153 (10.9) | 7 (2.8) | 791 (6.3) |
| (5) More than 100 million yen to 300 million yen | 45 (2.7) | 41 (2.9) | 4 (1.6) | 260 (2.1) |
| (6) More than 300 million yen | 16 (1.0) | 15 (1.1) | 1 (0.4) | 142 (1.1) |
| Total | 1,659 | 1,410 | 249 | 12,603 |

The figures in parentheses are the percentage of the number of corresponding firms in the sub-samples

Data source: *Basic Survey of Small and Medium-sized Enterprises* 2004

first column of panels B and C in Table 3, respectively. As seen in the tables, more than 60% of the firm owners in the sample pledged collateral or personal guarantees to their main banks. Actually, 18.4% of the firm owners pledged both collateral and personal guarantees.

As for the response of the main bank to a loan application, the loan application was accepted as is in nearly half of the cases. A loan application was turned down or reduced for only 7.1% of the sampled firms. It should be noted that for more than one-fourth of the firms, the main bank offered loans above the amount or with less stringent lending conditions than in the original applications.

Table 4 shows the mean, median and standard deviations of major items on the balance sheet and profit and loss statements as well as variables related to trade credit. The mean of total assets and sales are 1,385 and 1,860 million yen, while the corresponding medians are 369 and 584 million yen, respectively. Mean values far exceed median values, indicating that their frequency distributions are skewed to the right. The mean (median) of the number of employees is 58 (31). The average ratio of borrowing from financial institutions to total debt and that of short-term borrowing from financial institutions to current liabilities, proxies of bank dependence, are 0.52 and 0.30, respectively.[8]

The mean ratios of accounts receivable and accounts payable to sales are 0.150 and 0.118, respectively.[9] These ratios are much higher than those of small firms in the 1988 to 1989 NSSBF and are comparable to Compustat data on large firms in the U.S.[10] The mean ratio of accounts payable to total equity plus debt is 0.193, which is somewhat higher than U.S. counterparts (0.1578) in Berger and Udell (1998). Judging from these figures, the SMEs in Japan depend more on accounts payable as sources of

[8] The average ratio of borrowing from financial institutions to total debt for U.S. small firms is 0.5293 in Berger and Udell (1998), which is quite close to ours.

[9] In fact, 3.7% of firms recorded a zero balance on accounts payable.

[10] Petersen and Rajan (1997) reported that the mean ratio of accounts receivable and accounts payable to sales is 0.073 and 0.044, respectively, for the National Survey samples, while the corresponding ratios are 0.185 and 0.116 for the Compustat firms.

**Table 3** Attributes of sampled firms

| Attributes | (1) Number of firms in this study | (2) Number of solvent firms in this study | (3) Number of insolvent firms in this study | (4) Number of firms in the survey |
|---|---|---|---|---|
| Panel A: type of main bank | | | | |
| (1) City banks, long-term credit banks, and trust banks | 447 (26.9) | 404 (28.7) | 43 (17.3) | 3,266 (28.8) |
| (2) Regional and second-tier regional banks | 791 (47.7) | 678 (48.1) | 113 (45.4) | 4,871 (43.0) |
| (3) Shinkin banks and credit cooperatives | 362 (21.8) | 281 (19.9) | 81 (32.5) | 2,612 (23.1) |
| (4) Government financial institutions for SME | 42 (2.5) | 33 (2.3) | 9 (3.6) | 244 (2.2) |
| (5) Other government financial institutions | 4 (0.2) | 3 (0.2) | 1 (0.4) | 54 (0.5) |
| (6) Financial institutions for agriculture | 8 (0.5) | 8 (0.6) | 0 (0.0) | 124 (1.1) |
| (7) No main bank | 5 (0.3) | 3 (0.2) | 2 (0.8) | 151 (1.3) |
| Total | 1,659 | 1,410 | 249 | 12,603 |
| Panel B: terms of loan contract | | | | |
| (1) Physical collateral | 1,049 (63.2) | 906 (64.3) | 143 (57.4) | 5,496 (51.0) |
| (2) Personal guarantee | 1143 (68.9) | 979 (69.4) | 164 (65.9) | 6,020 (55.8) |
| (3) Third party guarantee | 256 (15.4) | 208 (14.8) | 48 (19.3) | 1,392 (12.9) |
| (4) Public guarantee | 746 (45.0) | 613 (43.5) | 133 (53.4) | 3,811 (35.4) |
| (5) Neither collateral nor guarantee | 103 (6.2) | 93 (6.6) | 10 (4.0) | 1,513 (14.0) |
| Total | 1,659 | 1,410 | 249 | 12,603 |
| Panel C: firm-specific main bank lending condition | | | | |
| (1) Loan application was rejected or reduced | 118 (7.1) | 63 (4.5) | 55 (22.1) | 544 (8.3) |
| (2) Loan application was accepted as it was | 739 (44.5) | 648 (46.0) | 91 (36.5) | 2,992 (45.9) |
| (3) The lending condition became severe | 354 (21.3) | 271 (19.2) | 83 (33.3) | 1,445 (22.1) |
| (4) The lending condition was loosened | 138 (8.3) | 130 (9.2) | 8 (3.2) | 532 (8.2) |
| (5) Additional loan was offered by the main bank | 310 (18.7) | 298 (21.1) | 12 (4.8) | 1,012 (15.5) |
| Total | 1,659 | 1,410 | 249 | 12,603 |

The figures in parentheses are the percentage of the number of corresponding firms in the sub samples. In column (4) of Panel A and C, adding up the numbers across rows is not equal to the total since original survey contains firms with incomplete information such as "no response." In Panel B, since the respondents can make more than two choices, the percentages of five choices do not sum up to 100

Data source: *Basic Survey of Small and Medium-sized Enterprises,* 2004

debt than do those in the United States. The mean ratios of purchases from large suppliers and small suppliers are 32.2 and 67.8%, respectively.[11,12]

Figure 1 shows the frequency distribution of the ratio of purchases from large suppliers. Approximately half of the sample firms make no purchases from large suppliers while one-tenth of the sample firms exclusively purchase from large suppliers. It should be noted that the ratios of purchases from large suppliers exhibit considerable variations across industries. Table 5 shows the mean and median ratios of purchases from large suppliers and borrowing to total debt as well as other important variables across industries. The mean ratio of purchases from large suppliers is highest in information and communications (64.4%) and lowest in hotels and restaurants (4.4%).

[11] The denominator of the ratio of purchases from large and small suppliers is purchases from domestic suppliers, excluding purchases from foreign suppliers. Hence, the ratios of purchases from large and small suppliers sum up to unity.

[12] The median proportion of purchases from large suppliers is only 5%, and its frequency distribution is heavily skewed to the right.

**Table 4** Descriptive statistics of major variables in the sample

| Statistics | (1) Mean | (2) Median | (3) Standard deviation |
|---|---|---|---|
| Account receivable | 304 | 52 | 746 |
| Account payable | 271 | 45 | 765 |
| Total assets | 1,385 | 369 | 4,421 |
| Total debt | 1,081 | 278 | 4,042 |
| Total sales, *SALES* | 1,860 | 584 | 4,088 |
| Number of employees (persons) | 58 | 31 | 84 |
| Operating profit | 40 | 6 | 183 |
| Borrowing from financial institutions | 583 | 132 | 2,739 |
| Ratio of purchase from small supplier | 0.678 | 0.950 | 0.390 |
| Ratio of purchase from large supplier, *LARGEVENDOR* | 0.322 | 0.050 | 0.390 |
| Account receivable/total sales | 0.150 | 0.122 | 0.148 |
| Account payable/total sales, *ACPAYABLE* | 0.118 | 0.087 | 0.115 |
| Account payable/(total debt + equity) | 0.193 | 0.145 | 0.186 |
| Total asset/total sales, *ASSET* | 0.904 | 0.640 | 1.146 |
| Operating profit/total sales, *PROFIT* | 0.012 | 0.013 | 0.105 |
| Borrowing from financial institutions/total debt, *BANKLOAN* | 0.520 | 0.545 | 0.258 |
| Short-term borrowing from financial institutions/current liabilities, *SHORTLOAN* | 0.300 | 0.250 | 0.278 |
| Total debt/total asset, *DEBT* | 0.858 | 0.830 | 0.450 |

Unit of the variables except for ratios and the number of employees is millions of yen. The capital letters after the variable definitions are the abbreviated variable names used in the regression analysis

Data source: *Basic Survey of Small and Medium-sized Enterprises,* 2004

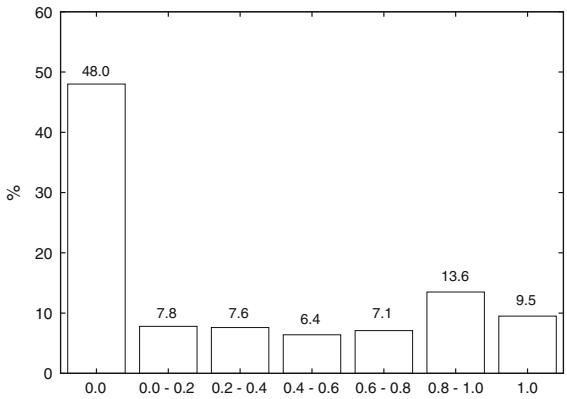


**Fig. 1** Frequency distribution of the ratio of purchases from large suppliers: *LARGEVENDOR*

## 4 Empirical examination of the redistributional view of trade credit

### 4.1 Specification of the redistributional hypothesis of trade credit

As stated in Sect. 2, we tested two key implications of the redistributional role of trade credit from the firm's demand side. First, we investigated the relationship of a customer's dependence on bank loans with the extent to which the customer purchases from large suppliers. We formalized this step as follows.

$$LARGEVENDOR_i = \alpha_0 + \alpha_1 \log SALES_i + \alpha_2 PROFIT_i + \alpha_3 DEBT_i + \alpha_4 BANKDEPEND_i + \sum_{J=1, J\neq 2}^{30} \beta_j DUMINDJ_i + \varepsilon_i \quad (1)$$

where $LARGEVENDOR_i$ is the proportion of intermediate goods purchased from large suppliers, $SALES_i$ is the sales, $PROFIT_i$ is the ratio of operating profit to sales, $DEBT_i$ is the debt-asset ratio, $BANKDEPEND_i$ is the customer's dependence on bank loans, $DUMINDJ_i$ is the industry dummies, and $\varepsilon_i$ is the i.i.d. error term.[13]

The dependent variable, $LARGEVENDOR_i$, is the fraction of intermediate goods purchased by firm $i$ from large suppliers. A customer's dependence on

[13] The subscript $i$ represents the $i$-th firm.

**Table 5** Means and medians of major variables

| Industry | (1) *LARGEVENDOR* | (2) *ACPAYABLE* | (3) *PROFIT* | (4) *ASSET* | (5) *BANKLOAN* | (6) *SHORTLOAN* | (7) *DEBT* |
|---|---|---|---|---|---|---|---|
| Panel A: mean | | | | | | | |
| (1) Construction | 0.242 | 0.126 | 0.017 | 0.809 | 0.454 | 0.303 | 0.731 |
| Manufacturing: (2) to (23) | 0.215 | 0.137 | 0.021 | 1.001 | 0.568 | 0.369 | 0.754 |
| (24) Information and communication | 0.644 | 0.054 | 0.013 | 0.654 | 0.537 | 0.302 | 0.762 |
| (25) Transportation | 0.238 | 0.081 | -0.009 | 0.824 | 0.562 | 0.279 | 0.853 |
| (26) Wholesale | 0.318 | 0.154 | 0.011 | 0.713 | 0.479 | 0.279 | 0.900 |
| (27) Real estate | 0.339 | 0.042 | 0.123 | 4.194 | 0.575 | 0.317 | 0.852 |
| (28) Restaurant and hotels | 0.044 | 0.034 | -0.017 | 1.427 | 0.597 | 0.290 | 0.885 |
| (29) Service | 0.275 | 0.075 | 0.011 | 1.093 | 0.519 | 0.260 | 0.833 |
| (30) Retail | 0.425 | 0.090 | 0.003 | 0.798 | 0.537 | 0.292 | 0.915 |
| Total | 0.322 | 0.118 | 0.012 | 0.904 | 0.520 | 0.300 | 0.858 |
| Panel B: median | | | | | | | |
| (1) Construction | 0.000 | 0.103 | 0.014 | 0.692 | 0.460 | 0.289 | 0.765 |
| Manufacturing: (2) to (23) | 0.000 | 0.116 | 0.019 | 0.897 | 0.603 | 0.338 | 0.776 |
| (24) Information and communication | 0.750 | 0.039 | 0.009 | 0.577 | 0.622 | 0.212 | 0.773 |
| (25) Transportation | 0.000 | 0.049 | 0.015 | 0.765 | 0.641 | 0.204 | 0.828 |
| (26) Wholesale | 0.100 | 0.121 | 0.011 | 0.556 | 0.483 | 0.234 | 0.845 |
| (27) Real estate | 0.000 | 0.030 | 0.096 | 3.621 | 0.611 | 0.254 | 0.872 |
| (28) Restaurant and hotels | 0.000 | 0.023 | 0.031 | 1.359 | 0.719 | 0.204 | 0.890 |
| (29) Service | 0.000 | 0.051 | 0.017 | 0.700 | 0.520 | 0.239 | 0.819 |
| (30) Retail | 0.300 | 0.067 | 0.008 | 0.528 | 0.580 | 0.240 | 0.863 |
| Total | 0.050 | 0.087 | 0.013 | 0.640 | 0.545 | 0.250 | 0.830 |

For the abbreviation of the variables, see the note in Table 4

Data source: *Basic Survey of Small and Medium-sized Enterprises,* 2004

bank loans, $BANKDEPEND_i$, is measured by two alternative variables: the ratio of borrowing from financial institutions to total debt, expressed by $BANKLOAN_i$, and the ratio of short-term borrowing from financial institutions to current liabilities, $SHORTLOAN_i$. The former captures the total relationship between the customer and the financial institution, while the latter emphasizes the short-term dependence. The correlation coefficient between $BANKLOAN_i$ and $SHORTLOAN_i$ is 0.5732. According to the redistributional view of trade credit, less dependence on bank loans makes customers more dependent on trade credit from large suppliers. Thus, we expect $\alpha_4$ to be negative.

A number of variables are used to control for firm attributes. First, firm size is measured by the logarithm of sales, or log $SALES_i$. A firm's profitability is measured by the ratio of operating profit to sales, or $PROFIT_i$. We include the debt-asset ratio, $DEBT_i$, to measure the debt burden of the firm. We also include 29 industry dummies, $DUMINDJ_i$.[14]

Second, we investigate the relationship between a customer's dependence on large suppliers and the amount of its accounts payable. We estimate the following reduced form equation for accounts payable.

[14] For a detailed industry classification, see Table 1. In the estimation, the second industry, food products, is taken as the base industry. Accordingly, we incorporate 29 constant dummy variables corresponding to the industry numbers (1) to (30) in the table, *DUMIND*1 to *DUMIND*30 except for *DUMIND*2.

$$ACPAYABLE_i = \delta_0 + \delta_1 ASSET_i + \delta_2 PROFIT_i + \delta_3 BANKDEPEND_i + \delta_4 LARGEVENDOR_i + \sum_{J=1}^{4} \phi_j CONTRACTJ_i + \sum_{J=1,J\neq 2}^{5} \eta_j LENDATTITUDEJ_i + \sum_{J=1,J\neq 2}^{30} \vartheta_j DUMINDJ_i + \xi_i \quad (2)$$

where $ACPAYABLE_i$ is the ratio of balance of accounts payable to sales, $ASSET_i$ is the ratio of total assets to sales, $CONTRACTJ_i$ is the terms of a loan contract with main bank, $LENDATTITUDEJ_i$ is the lending attitude of the main bank, and $\xi_i$ is the i.i.d. error term.

When the redistributional hypothesis of trade credit is valid, the customer who is more dependent on large suppliers will receive larger amounts of accounts payable. In other words, we expect $\delta_4$ to be positive. The effects of a firm's wealth and profitability on accounts payable are measured by the ratio of total assets to sales, $ASSET_i$, and profits to sales, $PROFIT_i$, respectively. The variable $BANKDEPEND_i$ measures the direct effect of bank dependence on accounts payable, taking a customer's dependence on large suppliers as constant. Even if the dependence on large suppliers remains unchanged, increasing availability of bank loans will reduce demand for accounts payable as long as bank loans are a cheaper source of funds than trade credit.

We control the effect of the loan supply conditions on accounts payable using two different variables. One is the terms of the loan contract with the main bank, or $CONTRACTJ_i$. The $CONTRACTJ_i$ variables are the dummy variables, each of which corresponds to the loan contract shown in rows 1–5 of panel B in Table 3; that is to say, $CONTRACT1_i$ takes unity if the firm owner pledges physical collateral to its main bank, $CONTRACT2_i$ takes unity if the firm owner guarantees to repay the principal in case of default and so on. The base is the case of neither collateral nor personal guarantee such that the number of dummies is four: *CONTRACT*1 to *CONTRACT*4.

The other variable is the firm-specific main bank lending conditions, $LENDATTITUDEJ_i$. The $LENDATTITUDEJ_i$ variable consists of the following four dummy variables that correspond to the firm-specific main bank lending conditions of rows 1–5 in panel C of Table 3: $LENDATTITUDE1_i$ takes unity if a loan application to its main bank was turned down or reduced, $LENDATTITUDE3_i$ takes unity if the firm-specific main bank lending conditions increase in severity, and so on. We incorporate four dummies, $LENDATTITUDE1_i$ to $LENDATTITUDE5_i$, with the exception of $LENDATTITUDE2_i$. The 29 industry dummies are also included as explanatory variables.

Taking the first and second implications together, we can say that the redistributional hypothesis of trade credit is valid only for the case where $\alpha_4 < 0$ in Eq. 1 and $\delta_4 > 0$ in Eq. 2 are supported simultaneously.

### 4.2 Micro data evidence on the redistributional hypothesis of trade credit

In estimating Eq. 1, we take endogeneity of sales into consideration. Sales and an unobservable error term of Eq. 1 may be negatively correlated as negative productivity shock to SMEs will reduce sales, and they thus become more dependent on large suppliers in anticipation of trade credit. The instrument is a dummy variable (*DUMBANKJ*) for the customer's type of main bank. As we explain in Sect. 3, main bank dummies consist of six dummies, each of which corresponds to one type of bank in rows 1–7 in panel A of Table 3; that is to say, *DUMBANK*2 takes unity if the main bank is a regional bank, *DUMBANK*3 takes unity if the main bank is a shinkin bank and credit cooperative, and so on. Because we select the case where the main bank is a city bank as the base, *DUMBANK*1 is omitted, and the number of main bank dummies is 6: *DUMBANK*2 to *DUMBANK*7.

Because $LARGEVENDOR_i$ is below unity and must be at least zero, we use a two-limit Tobit regression. The proportion of $LARGEVENDOR_i$ that takes zero is nearly 50%, as shown in Fig. 1. The estimation results of Eq. 1 by Tobit are shown in the first and second columns in panel A of Table 6. The third and fourth columns show the estimation results by instrumental variable Tobit with the Wald statistics to test endogeneity of sales. Instrumental variable Tobit is conducted in two steps. In the first step, we estimate the reduced form of sales by OLS and obtain the reduced-form OLS residuals. Then, in the second step, we estimate a standard Tobit of

**Table 6** Determinants of ratio of purchase from large firms, *LARGEVENDOR*

| Determinants | Tobit estimation | | Tobit estimation with instrumental variables | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Panel A: basic regression | | | | |
| *CONST.* | −2.1571 (9.81)*** | −2.3165 (10.9)*** | −2.0307 (3.84)*** | −2.1936 (4.26)*** |
| Log *SALES* | 0.1662 (12.2)*** | 0.1703 (12.3)*** | 0.1563 (3.78)*** | 0.1603 (3.84)*** |
| *PROFIT* | −0.2107 (1.02) | −0.2280 (1.10) | −0.1902 (0.86) | −0.2078 (0.94) |
| *DEBT* | 0.1080 (2.33)** | 0.1115 (2.39)** | 0.0994 (1.72)* | 0.1028 (1.76)* |
| *BANKLOAN* | −0.2392 (3.02)*** | | −0.2403 (3.03)*** | |
| *SHORTLOAN* | | −0.0979 (1.32) | | −0.0907 (1.13) |
| $\sigma$ | 0.7136 | 0.7157 | | |
| *n* (0,1) | 1,659 (797,158) | 1,658 (796, 158) | 1,659 (797,158) | 1,658 (796, 158) |
| Log of likelihood | −1,447.4 | −1,450.1 | | |
| Wald $\chi^2$ | | | 0.03 | 0.03 |
| Pseudo $R^2$ | 0.0958 | 0.0937 | | |
| Panel B: regression with insolvent dummy variable, *DUMINSOLVENT* | | | | |
| *CONST.* | −2.2791 (9.60)*** | −2.4642 (10.5)*** | −2.2355 (4.25)*** | −2.3928 (4.64)*** |
| Log *SALES* | 0.1647 (11.1)*** | 0.1733 (11.5)*** | 0.1614 (3.69)*** | 0.1674 (3.78)*** |
| *PROFIT* | −0.3477 (1.47) | −0.3563 (1.50) | −0.3402 (1.39) | −0.3449 (1.40) |
| *DEBT* | 0.2947 (2.43)** | 0.2110 (1.77)* | 0.2959 (2.40)** | 0.2120 (1.78)* |
| *BANKLOAN* | −0.3395 (3.80)*** | | −0.3402 (3.70)*** | |
| *SHORTLOAN* | | −0.1476 (1.79)* | | −0.1439 (1.66)* |
| *DUMINSOLVENT* | 0.8281 (1.22) | 1.0117 (1.52) | −0.6203 (0.35) | −0.4066 (0.22) |
| Log *SALES* × *DUMINSOLVENT* | −0.0313 (0.68) | −0.0407 (0.88) | 0.0883 (0.60) | 0.0766 (0.50) |
| *PROFIT* × *DUMINSOLVENT* | 0.5417 (1.11) | 0.5427 (1.11) | 0.2989 (0.53) | 0.3115 (0.55) |
| *DEBT* × *DUMINSOLVENT* | −0.2250 (1.62) | −0.1408 (1.03) | −0.1799 (1.19) | −0.0972 (0.65) |
| *BANKLOAN* × *DUMINSOLVENT* | 0.3790 (1.69)* | | 0.3546 (1.54) | |
| *SHORTLOAN* × *DUMINSOLVENT* | | 0.2417 (1.19) | | 0.1960 (0.91) |
| $\sigma$ | 0.7064 | 0.7094 | | |
| *n* (0,1) | 1,645 (783,158) | 1,644 (782,158) | 1,644 (782,158) | 1,643 (781,158) |
| Log of likelihood | −1,431.9 | −1,436.5 | | |
| Wald $\chi^2$ | | | 0.23 | 0.20 |
| Pseudo $R^2$ | 0.0995 | 0.0961 | | |

The figures in parentheses are the *t*-values for Tobit model and *z*-values for Tobit model with instrumental variables in absolute value. The symbols *, ** and *** indicate that the corresponding coefficients are significant at 10, 5 and 1%, respectively. $\sigma$ is the estimated standard error of the regression. Wald $\chi^2$ is for the test of endogeneity of log of *SALES*. The symbol $n(0,1)$ stands for the number of observations and the figures in parenthesis are the number of observations censored at 0 and 1, respectively. To avoid the collinearity caused by the cross-term of *DUMINSOLVENT* with industry dummy variables or main bank dummy variables as instruments, 15 observations are omitted from the sample in the regression with *DUMINSOLVENT*. Similarly, a sample firm with missing current liabilities data is omitted in the regression with *SHORTLOAN*

*LARGEVENDOR* on the original variables plus the residual. We then obtain the consistent estimates of the parameters.[15] The Wald test cannot reject exogeneity of sales, irrespective of the measure of a customer's dependence on financial institutions. When $BANKLOAN_i$ is used as a measure of a customer's dependence on financial institutions, the coefficient estimate of $BANKLOAN_i$ is significantly negative, which implies that the customer who is more dependent on bank loans will purchase less from large suppliers. This is consistent with the

[15] See Smith and Blundell (1986) for more details on instrumental variable Tobit.

redistributional hypothesis of trade credit. On the other hand, when $SHORTLOAN_i$ is used instead of $BANKLOAN_i$, its coefficient is negative but not significant. We also find that the customer with a higher debt-asset ratio tends to purchase more from large suppliers, irrespective of the customer-bank relationship variable. This finding might reflect increasing difficulty for the customer burdened with heavy debt to borrow from banks.

We turn to the estimation results of Eq. 2.[16] First, we examine endogeneity of *LARGEVENDOR* by the Durbin–Wu–Hausman (DWH) test. The instruments are debt-asset ratio and six main bank dummies.[17] The DWH statistics are 3.28 and 5.75 for *BANKLOAN* and *SHORTLOAN* cases, respectively, such that exogeneity of *LARGEVENDOR* is rejected at the 5% significance level for the *SHORTLOAN* case. The estimation results by instrumental variables are shown in the first and second columns of Table 7. To test whether the additional instruments are valid in the sense that they are uncorrelated with the error term, we conduct the Sargan test. The Sargan test cannot reject the over-identification restrictions at the 5% significance level for either a *BANKLOAN* or *SHORTLOAN* case.

We find that the customer with large assets relative to sales who is less dependent on banks has more accounts payable. Furthermore, the $LARGEVENDOR_i$ variable exerts a significantly positive effect on accounts payable, irrespective of the customer-bank relationship variable. In other words, when a purchase is made from large suppliers, more credit is provided in the form of trade credit. This is also consistent with the redistributional hypothesis. To combine the evidence obtained from the estimation of the two equations above, we confirm the redistributional role of trade credit for Japanese SMEs. When a firm does not have close ties with financial institutions, it tends to purchase from large suppliers to secure credit, which, in turn, leads to an increase in accounts payable.

To see the quantitative importance of the redistributional role of trade credit, we compute the difference in the ratio of accounts payable to sales across industries coming from the difference in $LARGEVENDOR_i$. As presented in the previous section, the $LARGEVENDOR_i$ variable exhibits wide variations across industries. The *LARGEVENDOR* ranges from 0.644 for information and communication to 0.044 for hotels and restaurant, as is shown in Table 5. Thus, the difference in the ratio of purchases from large suppliers makes a 9.6 ($0.1599 \times 0.6$) percentage point to a 12.6 ($0.2103 \times 0.6$) percentage point difference in the ratio of accounts payable to sales at the maximum.

### 4.3 The redistributional hypothesis and firm distress

To see whether the redistributional role of trade credit is prevalent across firms, we re-estimate Eqs. 1 and 2 and classify firms into two different groups. One group consists of firms whose debt exceeds total assets, or insolvent firms, and the other group consists of solvent firms whose debt is less than their total assets. Before examining the estimation results, we compare firm characteristics between solvent and insolvent firms. The second and third columns of Tables 2 and 3 show firm size in terms of number of employees and equity capital, type of main bank, terms of loan contract and firm-specific main bank lending conditions for both solvent firms and insolvent firms. Insolvent firms are generally smaller in terms of number of employees and equity capital. The main banks of insolvent firms are also smaller in size as 17.3% (28.7%) of main banks for insolvent (solvent) firms are city banks, long-term credit banks and trust banks, whereas 32.5% (19.9%) are shinkin banks and credit cooperatives.

Table 8 compares the descriptive statistics of major variables between solvent and insolvent firms. Insolvent firms earn much less operating profit than solvent firms. Insolvent firms are less dependent on bank loans in terms of total and short-term borrowing and less dependent on large suppliers. As for the ratio of accounts payable to sales, there is no difference between solvent and insolvent firms, although the

[16] Although accounts payable are zero for some firms, the proportion of such firms is only 3.7% of the sampled firms; therefore, we do not use Tobit-type estimation.

[17] In the first step, we fail to reject exogeneity of sales, which might justify the use of the sales variable as a valid instrument. However, when we allow for different responses of trade credit to bank dependence for solvent and insolvent firms, it turns out that the Sargan test rejects over-identification restrictions when the sales variable is included as an instrument. Therefore, we do not use sales as an instrument.

**Table 7** Determinants of account payable ratio, *ACPAYABLE*

| Determinants | Without *DUMINSOLVENT* | | With *DUMINSOLVENT* | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *CONST.* | 0.0744 (2.98)*** | 0.0511 (2.18)** | 0.0049 (0.15) | 0.0036 (0.12) |
| *LARGEVENDOR* | 0.1599 (2.08)** | 0.2103 (2.51)** | 0.4250 (5.14)*** | 0.4382 (4.74)*** |
| *PROFIT* | 0.0109 (0.41) | 0.0101 (0.35) | −0.0073 (0.15) | −0.0065 (0.14) |
| *ASSET* | 0.0321 (10.8)*** | 0.0330 (9.88)*** | 0.0416 (8.23)*** | 0.0434 (8.04)*** |
| *BANKLOAN* | −0.1103 (7.69)*** | | −0.0894 (3.92)*** | |
| *SHORTLOAN* | | −0.0992 (8.96)*** | | −0.1126 (6.55)*** |
| *CONTRACT*1 | 0.0163 (2.09)** | 0.0096 (1.25) | 0.0056 (0.50) | 0.0035 (0.32) |
| *CONTRACT*2 | 0.0100 (1.49) | 0.0053 (0.69) | 0.0232 (2.15)** | 0.0190 (1.64) |
| *CONTRACT*3 | 0.0138 (1.61) | 0.0157 (1.66)* | 0.0303 (2.30)** | 0.0309 (2.26)** |
| *CONTRACT*4 | 0.0130 (2.00)** | 0.0082 (1.10) | 0.0301 (2.97)*** | 0.0250 (2.30)** |
| *LENDATTITUDE*1 | 0.0026 (0.23) | −0.0020 (0.16) | −0.0278 (1.22) | −0.0308 (1.30) |
| *LENDATTITUDE*3 | 0.0109 (1.48) | 0.0072 (0.92) | −0.0013 (0.10) | −0.0014 (0.11) |
| *LENDATTITUDE*4 | −0.0107 (1.04) | −0.0150 (1.34) | −0.0157 (0.99) | −0.0189 (1.16) |
| *LENDATTITUDE*5 | −0.0170 (2.07)** | −0.0200 (2.23)** | −0.0267 (2.23)** | −0.0285 (2.32)** |
| *DUMINSOLVENT* | | | 0.2111 (2.03)** | 0.1972 (1.91)* |
| *LARGEVENDOR* × *DUMINSOLVENT* | | | −0.4804 (2.46)** | −0.4843 (2.37)** |
| *PROFIT* × *DUMINSOLVENT* | | | 0.1508 (1.50) | 0.1466 (1.44) |
| *ASSET* × *DUMINSOLVENT* | | | −0.0163 (1.64) | −0.0191 (1.87)* |
| *BANKLOAN* × *DUMINSOLVENT* | | | 0.0386 (0.80) | |
| *SHORTLOAN* × *DUMINSOLVENT* | | | | 0.0551 (1.28) |
| *CONTRACT*1 × *DUMINSOLVENT* | | | −0.0294 (1.09) | −0.0252 (0.93) |
| *CONTRACT*2 × *DUMINSOLVENT* | | | −0.0048 (0.18) | −0.0019 (0.07) |
| *CONTRACT*3 × *DUMINSOLVENT* | | | −0.0452 (1.41) | −0.0457 (1.40) |
| *CONTRACT*4 × *DUMINSOLVENT* | | | −0.0385 (1.57) | −0.0365 (1.45) |
| *LENDATTITUDE*1 × *DUMINSOLVENT* | | | 0.0852 (2.22)** | 0.0824 (2.12)** |
| *LENDATTITUDE*3 × *DUMINSOLVENT* | | | 0.0236 (0.78) | 0.0187 (0.62) |
| *LENDATTITUDE*4 × *DUMINSOLVENT* | | | −0.0242 (0.36) | −0.0251 (0.37) |
| *LENDATTITUDE*5 × *DUMINSOLVENT* | | | 0.0552 (0.85) | 0.0615 (0.94) |
| *n* | 1,659 | 1,658 | 1,659 | 1,658 |
| $cR^2/nR^2$ | 0.1049 0.5673 | −0.0469 0.4942 | −1.0437 0.0122 | −1.1029 0.0160 |
| *F* | 11.4*** | 8.98*** | 3.37*** | 2.92*** |
| Root *MSE* | 0.1084 | 0.1172 | 0.1637 | 0.1661 |
| *DWH* $\chi^2$ | 3.28* | 5.75** | 67.8*** | 54.7*** |
| Sargan $\chi^2$ | 12.4* | 12.2* | 11.8 | 11.1 |

The symbols $cR^2$ and $nR^2$ stand for centered $R^2$ and non-centered $R^2$, respectively. *F* is for the test of zero slope coefficients. *DWH* $\chi^2$ is for the Durbin–Wu–Hausman test of endogeneity of *LARGVENDOR*. Sargan $\chi^2$ is for the test of over-identifying restrictions

ratio of accounts receivable to sales is lower for insolvent firms.

Equations 1 and 2 are re-estimated by incorporating an insolvent dummy (*DUMINSOLVENT*) and its interacting terms with explanatory variables. The estimation results of Eq. 1 by Tobit are shown in the first and second columns in panel B of Table 6 and those by instrumental variable Tobit are shown in the third and fourth columns in panel B of Table 6. Exogeneity of sales is not rejected by the Wald test for either a *BANKLOAN* or *SHORTLOAN* case. The estimation results of Eq. 2 by instrumental variables

**Table 8** Descriptive statistics of major variables in the sub-sample

| Statistics | (1) Solvent firms | (2) | (3) Insolvent firms | (4) |
|---|---|---|---|---|
| | Mean | Median | Mean | Median |
| Account receivable | 349 | 69 | 53 | 12 |
| Account payable | 309 | 59 | 55 | 10 |
| Total assets | 1,571 | 524 | 329 | 74 |
| Total debt | 1,203 | 347 | 391 | 99 |
| Total sales, *SALES* | 2,114 | 744 | 419 | 133 |
| Number of employees (person) | 64 | 36 | 22 | 8 |
| Operating profit | 47 | 9 | −1 | 0 |
| Borrowing from financial institutions | 645 | 169 | 228 | 43 |
| Ratio of purchase from small supplier | 0.671 | 0.900 | 0.721 | 1.000 |
| Ratio of purchase from large supplier, *LARGEVENDOR* | 0.329 | 0.100 | 0.279 | 0.000 |
| Account receivable/total sales | 0.155 | 0.126 | 0.119 | 0.089 |
| Account payable/total sales, *ACPAYABLE* | 0.119 | 0.088 | 0.114 | 0.082 |
| Account payable/(total debt + equity) | 0.186 | 0.142 | 0.233 | 0.152 |
| Total asset/total sales, *ASSET* | 0.907 | 0.662 | 0.887 | 0.499 |
| Operating profit/total sales, *PROFIT* | 0.018 | 0.014 | −0.021 | 0.000 |
| Borrowing from financial institutions/total debt, *BANKLOAN* | 0.525 | 0.556 | 0.495 | 0.492 |
| Short-term borrowing from financial institutions/current liabilities, *SHORTLOAN* | 0.306 | 0.263 | 0.266 | 0.148 |
| Total debt/total asset, *DEBT* | 0.746 | 0.792 | 1.496 | 1.221 |

See the note in Table 4

Data source: *Basic Survey of Small and Medium-sized Enterprises,* 2004

are shown in the third and fourth columns of Table 7.[18] The $BANKLOAN_i$ variable exerts a significantly negative effect on $LARGEVENDOR_i$, which, in turn, affects accounts payable in a significantly positive manner. When the $SHORTLOAN_i$ variable is used, its coefficient is negative and barely significant at the 10% level in Eq. 1 and significantly negative at the 1% level in Eq. 2. It implies that the redistributional role of trade credit is valid for solvent Japanese SMEs.

On the other hand, the cross term of bank dependence with insolvent dummy is insignificant in Eq. 1 except for a *BANKLOAN* case by Tobit estimation. Thus, there is no difference in the effects of bank dependence on the proportion of purchase from large suppliers between solvent and insolvent SMEs. In Eq. 2, the coefficient estimate of the cross term of $LARGEVENDOR_i$ with insolent dummy is significantly negative. The marginal effect of *LARGEVENDOR* on accounts payable for insolvent firms is nearly zero.[19] Thus, even if the insolvent firm increases its purchases from large suppliers, accounts payable are not necessarily extended to the insolvent firms.

In summary, the redistributional hypothesis of trade credit is only applicable for solvent SMEs, not for insolvent SMEs.

### 4.4 Substitutability between bank loans and trade credit

Note that the coefficient estimate of $LENDATTITUDE1_i$, which indicates that the loan application is

[18] The instruments we use are debt-asset ratio, six main bank dummies and their cross terms with insolvent dummy.

[19] In fact, the marginal effects of *LARGEVENDOR* on *ACPAYABLE* for insolvent firms are −0.0554 and −0.0461 for *BANKLOAN* and *SHORTLOAN* cases, respectively.

rejected or reduced by the main bank, is significantly positive for insolvent firms in Table 7, while it is not significant for solvent firms. When a loan application submitted to a main bank by an insolvent firm is rejected or reduced, it is accompanied by an increase in accounts payable. This suggests that accounts payable are a substitute for bank loans for insolvent firms. The importance of trade credit for insolvent firms is also seen from the significantly positive coefficient of the dummy variable, *DUMINSOLVENT*, in the third and fourth columns of Table 7.[20] This appears a bit contradictory to the evidence above that finds the redistributional role of trade credit is not supported for insolvent firms. We interpret this puzzling evidence as follows. When a loan application is rejected by the main bank, the insolvent firm tries to secure credit in the form of trade credit. Note that 73% of insolvent firms are very small with equity capital less than 10 million yen (panel B of Table 2). The estimation results of Eq. 1 show that smaller firms, measured by the logarithm of sales, tend to purchase from smaller suppliers. Therefore, it may be the case that trade credit for insolvent small firms is not necessarily supplied by large suppliers but by SME suppliers that do not, in general, have easy access to other sources of funds.[21] This implies that substitutability between bank loans and trade credit for insolvent firms is independent of the redistributional hypothesis.

### 4.5 Evidence by industry

For a check of robustness, we estimate Eqs. 1 and 2 separately for major industries that have a sufficient number of observations. In our estimation, we include an insolvent dummy and its interactive terms with explanatory variables. We selected four industries: manufacturing, wholesale, service and retail industries. The estimation results of Eq. 1 are shown in panel A of Table 9. To save space, we show only the coefficient estimates of *BANKLOAN* and *SHORTLOAN* by Tobit and instrumental variable Tobit. The effect of customer's dependence on bank loans on the proportion of purchases from large suppliers is negative for all industries and significant at the 5% level for manufacturing and wholesale industries.

The estimation results of Eq. 2 estimated by instrumental variables are shown in panel B of Table 9. To save space, we show only the coefficient estimates of *LARGEVENDOR* with the DWH statistics and the Sargan statistics. The DWH statistics indicate that *LARGEVENDOR* is endogenous, and the Sargan statistics indicate that the instrumental variables are indeed valid. The coefficient estimate of *LARGEVENDOR* is significantly positive in all four industries. To sum up the estimation results by industry, the redistributional hypothesis is supported in the manufacturing industry where intermediate goods are actively transacted across sectors.

## 5 Concluding remarks

This article investigates the redistributional role of trade credit from the demand side based on unique micro data from Japanese SMEs for which information on transactions between firms of different sizes is available. Two implications of the redistributional hypothesis are tested. First, we examine the relationship of bank dependence, measured by the ratio of borrowing from financial institutions to total debt, and the ratio of short-term borrowing from financial institutions to current liabilities with dependence on large suppliers. Second, we examine the effect of a dependence on large suppliers on the amount of accounts payable. We find evidence supporting the redistributional hypothesis for solvent firms. In other words, less dependence on bank loans will make customers more dependent on large suppliers, which, in turn, leads to an increase in accounts payable.

However, the redistributional hypothesis is not supported for insolvent firms. It is true that substitutability is observed between bank loans and trade

[20] As for the importance of trade credit for insolvent firms, Petersen and Rajan (1997) argue that suppliers are more willing than banks to renegotiate their claims or grant additional debt when their customers get into financial distress as suppliers' rents from selling goods to their customers are lost if the customers are liquidated upon default. Wilner (2000) also argues that suppliers are more dependent on their customers than credit market lenders. Similarly, Franks and Nyborg (1996) show that sunk investments in the customer–supplier relationship make suppliers more lenient toward financially distressed customers. Using Belgian data on first-time business start-ups, Huyghebaert et al. (2007) found that firms in industries with high historical start-up failure rates and entrepreneurs who highly value private benefits of control prefer trade credit to bank loans.

[21] In this case, insolvency might be propagated to other SME suppliers that extend credit to insolvent firms, as their balance sheets also deteriorate.

**Table 9** Estimation by industry

| Industry | (1) *BANKLOAN* | | | (2) *SHORTLOAN* | | |
|---|---|---|---|---|---|---|
| Panel A: | (1) *LARGEVENDOR* equation by Tobit estimation | | | | | |
| | *BANKLOAN* | | | *SHORTLOAN* | | |
| Whole industry | −0.3395 (3.80)*** | | | −0.1476 (1.79)* | | |
| Manufacturing | −0.5897 (2.85)*** | | | −0.3533 (1.90)* | | |
| Wholesale | −0.1714 (1.35) | | | −0.0342 (0.29) | | |
| Service | −0.5777 (1.56) | | | −0.0942 (0.26) | | |
| Retail | −0.3418 (1.74)* | | | −0.2243 (1.26) | | |
| | (2) *LARGEVENDOR* equation by Tobit estimation with instrumental variables | | | | | |
| | *BANKLOAN* | | | *SHORTLOAN* | | |
| Whole industry | −0.3402 (3.70)*** | | | −0.1439 (1.66)* | | |
| Manufacturing | −0.6172 (2.91)*** | | | −0.3895 (1.82)* | | |
| Wholesale | −0.1993 (1.40) | | | −0.0112 (0.09) | | |
| Service | −0.5095 (1.30) | | | −0.8260 (2.12)** | | |
| Retail | −0.3596 (1.81)* | | | −0.1566 (0.76) | | |
| Panel B: | *ACPAYABLE* equation by instrumental variables | | | | | |
| | *LARGEVENDOR* | *DWH* $\chi^2$ | Sargan $\chi^2$ | *LARGEVENDOR* | *DWH* $\chi^2$ | Sargan $\chi^2$ |
| Whole industry | 0.4250 (5.14)*** | 67.8*** | 11.8 | 0.4382 (4.74)*** | 54.7*** | 11.1 |
| Manufacturing | 0.8224 (2.33)*** | 52.2*** | 1.96 | 0.8845 (1.89)* | 37.3*** | 2.20 |
| Wholesale | 0.3850 (3.36)*** | 20.3*** | 27.4*** | 0.3826 (3.29)*** | 15.5*** | 30.6*** |
| Service | 0.2201 (2.77)*** | 9.38*** | 12.6* | 0.2197 (2.13)** | 18.5*** | 3.20 |
| Retail | 0.1864 (2.13)*** | 10.3*** | 4.11 | 0.1801 (1.94)* | 7.38** | 4.51 |

See notes in Tables 6 and 7 for the notation

credit even for insolvent firms, but substitutability is independent of the extent to which purchases are made from large suppliers.

Our findings have important implications on the financing behavior of young small firms. In general, young firms are informationally opaque, which makes it difficult for them to have easy access to external finances, forcing them to rely on inside financing, venture capital and/or angel financing. Our study suggests that in addition to these financing means, trade credit is also an important source for young firms with little access to bank loans.[22] In the course of daily transactions of intermediate goods, suppliers will be able to accumulate information on small customers. Therefore, the perpetual transactions with a certain supplier may signal the quality of young firms to financial institutions, which will eventually help young firms to appropriate external financing. In this way, trade credit plays an important role for infant firms over the long-term financial growth cycle.

**Acknowledgments** This research was financially supported by the Japan Economic Research Foundation in 2006 and Grant-in-Aid for Scientific Research (#19330044) from the Japanese Ministry of Education, Culture, Sports, Science and Technology in 2007. We are grateful to Philipp D. Koellinger, associate editor of this journal, two anonymous referees and the participants of the seminars at the University of Groningen and the RIETI Corporate Finance and Network Research Group for

[22] Berger and Udell (1998), Reid (2003) and Huyghebaert and Van de Gucht (2007) reported that suppliers and commercial banks are the largest provider of credit for start-up firms. Petersen and Rajan (1994, 1995) found that as U.S. small firms age and their relationships with financial institutions mature, they become less dependent on trade credit. Fisman and Love (2003) and Burkart and Ellingsen (2004) show that trade credit

Footnote 22 continued
constitutes an important source of funding for firms constrained in financial markets.

extremely helpful comments and suggestions. Any remaining errors are the sole responsibility of the authors.

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